Science 8

Module 1

Mix and Flow of Matter

Home Instructor's Guide and Assignment Booklet 1B

Learning Technologies Branch

Alberta LEARNING

Science 8
Module 1: Mix and Flow of Matter
Home Instructor's Guide and Assignment Booklet 1B
Learning Technologies Branch
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The Learning Technologies Branch acknowledges with appreciation the Alberta Distance Learning Centre and Pembina Hills Regional Division No. 7 for their review of this Home Instructor's Guide and Assignment Booklet.

This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	✓
General Public	
Other	

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- Learning Technologies Branch, **http://www.learning.gov.ab.ca/ltb**
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Section 2: Properties of Fluids

In this section your student will investigate these properties of fluid samples: viscosity, density, and buoyancy. Your student will also use the particle model of matter to gain a fundamental understanding of these properties and will compare liquids and gases on the basis of these properties. Your student will also see how these properties are related to the design and operation of technological devices.

The following materials will be needed to complete this section.

Section 2: Lesson 1

- a flat sheet of plastic (at least 50 cm by 30 cm) to serve as a ramp
- a stack of books to support the high end of a ramp
- a thermometer
- a 15 mL-measuring spoon or a tablespoon with a round bottom
- a stopwatch or a watch with a second hand
- a waterproof type felt-tip marker pen
- adhesive tape
- paper towels
- soap
- a 100-mL graduated cylinder
- a marble or another small, heavy object
- graph paper
- 15-mL or tablespoon samples of any three of these: water; liquid detergent; honey; molasses; vegetable oil; corn syrup

Section 2: Lesson 2

- two medium-sized water glasses (approximately 200-mL size)

Section 2: Lesson 3

- a wide-mouthed transparent jar with a screw-on lid
- food colouring
- paper clips—two or three different sizes
- a cork
- a toothpick or a wood chip
- water
- vegetable oil
- a 100-mL graduated cylinder
- two waterproof objects—one that sinks in water and one that floats in water
- a spring scale
- several light-weight plastic bags with locking seals
- a pitcher or a large measuring cup with a spout
- a cake pan
- a 1-L plastic pop bottle with a cap
- a medicine dropper

Suggested Answers

Section 2: Lesson 1

1. a. A controlled variable (CV) is the variable in an investigation that is not allowed to change.

b. A responding variable (RV) is the variable in an investigation that changes in response to a change in the manipulated variable.

c. Quantitative data is numerical information that is absolute—it doesn't require a comparison. It's usually obtained through measurement or calculation. For example, It is 22°C today.

d. Qualitative data is non-numerical information that relies on a comparison between objects—it's gathered without measurement. For example, It is warmer today than it was yesterday.

The "l" in *qualitative* is a reminder that "language" is used for information instead of numbers.

2. Textbook questions (a) and (e) from "Instant Practice," page 496:

There are two parts to each observation.

(a) Qual, Quan
(e) Quan, Qual

3. a. The purpose is to investigate the effects of the number of filtering layers on the clarity of the water.

b. The manipulated variable is the number of filtering layers used.

c. The responding variable is the clarity of the water.

6. Answers will vary, but the answer should be like the following.

Two sample hypotheses follow.

If you **increase** the **thickness of the liquid,** then the **flow rate** will **decrease** because **more particles will be packed closer together in a thicker liquid. The closely packed particles will not get past each other as easily.**

If you **change** the **type of the liquid,** then the **flow rate** will **change** because **the attractive forces between particles are stronger in some types of liquids. The stronger forces among particles will keep particles from moving past each other as easily.**

7. Students can use a table similar to this to store their information.

Flow Rate Measurements				
Liquid	**Time (s)**	**Flow Rate (cm/s)**	**Ranked Flow Rate (highest to lowest)**	**Ranked Viscosity (lowest to highest)**
Water				
Liquid 2				
Liquid 3				

8. Answers will vary.

For the MV, students will use the viscosity or thickness of the liquid or the type of liquid.

For the RV, students will test the speed at which an object falls, the rate at which an object falls, or the time required to fall through the liquid.

Significant controlled variables include the following:

- the shape, weight, texture, material, and cleanliness of the object
- the height from which the object falls before entering the fluid
- the distance the object falls through the fluid
- the force with which the object is released
- the timing technique
- fluid temperature should be controlled if the MV is the type of liquid

9. Answers will vary. How does the viscosity of a fluid affect the rate at which an object falls through the liquid? How does the thickness of the liquid affect the time required to fall through the liquid?

10. Answers will vary. But the answer should be like the following.

If you **increase** the **thickness of the liquid,** then the **falling speed of the falling object** will **decrease** because **more particles will be packed closer together in a thicker liquid. The closely packed particles will not get out of the way of the falling object as easily.**

11. Answers will vary. Only one test object—a controlled variable—is needed.

Comments: Varying the object would be an interesting additional investigation students could try for fun after completing this one. Your student may list a bead, cooking oil, molasses, syrup, a graduated cylinder, a stopwatch, and water. Only allow materials that are safe to use.

12. Answers will vary. The following is a sample procedure.

Step 1: Select at least three liquids that represent a wide range of viscosities.

Step 2: Pour 100 mL of the first liquid into the graduated cylinder.

Step 3: Drop the marble from just above the cylinder's lip into the centre of the liquid.

Step 4: Measure and record the time the marble takes to fall through the liquid. Start when the marble is released. Stop when the marble touches the bottom of the cylinder.

Step 5: Repeat steps 3 and 4 one more time. This step would increase the data's accuracy. Students would average the measurements to get the final time.

Comment: However, while it is a good idea, it is not very practical because it can be very messy. Instead, students should try to time the falls fairly accurately and repeat them only if the timing error is a concern.

Step 6: Thoroughly clean the cylinder and the marble. Repeat steps 2 to 5 with each of the remaining fluids.

13. The following table can be used as an example.

Falling Rates		
Viscosity	**Fall Time (s)**	**Ranked Fall Rate**
Liquid A		
Liquid B		
Liquid C		

Note: If students have chosen to use viscosity as their MV, they should use the results of Part 1 to classify liquids.

Note: If students choose to run three trials with each liquid, the "Fall Time" column would be further subdivided to accommodate the three trials and their averages.

14. The viscosity—resistance to flow—of the furniture-stripping liquid was increased so that it would stay on vertical surfaces longer.

15. a. Slushes have a higher viscosity—they are thicker and therefore have a greater resistance to flow—than do soft drinks. A wider straw is needed for a high-viscosity fluid.

b. The larger pipe is used for the oil pipeline. Fluids with high viscosities have a higher resistance to flow than do fluids with low viscosities. The high-viscosity particles are more densely packed and may have a greater attraction to one another, making it more difficult for them to move past each other. To move the same volume of material, the diameter of the oil pipe must be larger than the water pipe.

16. Textbook questions 2 to 4 from "Topic 4 Review," page 49:

2. Generally, the higher the viscosity, the slower the flow rate. The lower the viscosity, the faster the flow rate.

3. You can test the viscosity of a liquid by

    - pouring a small sample of the liquid down a smooth slope and observing its flow rate
    - stirring or agitating it
    - dripping it out of a container
    - measuring the time it takes to flow through a hole in a container

4. (a) Generally, heating a liquid increases the flow rate—it decreases viscosity—and cooling decreases the flow rate—it increases viscosity.

    (b) Heating a gas decreases the flow rate—it increases viscosity—and cooling increases the flow rate—it decreases viscosity.

    (c) Particles of a liquid move faster and farther apart when heated, but they remain attracted to one another. The increase in temperature makes it easier for the liquid particles to slide past each other. Gas particles also move faster but they tend to collide more often when they're moving fast. This increases their viscosity, which is the resistance to flow.

Section 2: Lesson 2

1. A substance in its liquid state is less dense than it is in its solid state and is more dense than in its gaseous state—water is an exception. The particles of a solid are closest to one another. In a liquid they are farther apart but are still in contact with each other. In a gas there are larger spaces between the particles.

2. The particles of a fluid are free to move individually. When a force is applied to them, they simply move out of the way. The denser a fluid, the more particles there are packed into the same space. Therefore, more particles have to be pushed out of the way, and there is less empty space for them to move into. The result is that the denser a fluid, the harder it is to move through. It has higher resistance to your motion.

   The particles of solids are stuck in place by strong, attractive forces. Such particles cannot move individually. To move through the solid the student would have to overcome the strong forces holding particles in fixed positions.

3. The substances or objects would settle in the following order from top to bottom: an oak block, machine oil, water, and mercury.

4. Mass is the amount of matter in an object.
   Volume is the measurement of the amount of space occupied by a substance.
   Weight is the force of gravity exerted on a mass.

5. Mass is the amount of matter in an object. Weight is the force of gravity acting on the mass of an object.

6. **Textbook question, "Math Connect," page 55:**

   The following conversion illustrates a mass-to-volume ratio.

$$\frac{6\ \text{g}}{25\ \text{mL}} \times \frac{4}{4} = \frac{24\ \text{g}}{100\ \text{mL}} = 0.24\ \text{g/mL}$$

7. **a.** Volume = length × width × height

$$= 30\ \text{cm} \times 10\ \text{cm} \times 4\ \text{cm}$$

$$= 1200\ \text{cm}^3$$

   b. $\text{Density} = \dfrac{\text{mass}}{\text{volume}}$

$$= \frac{2000\ \text{g}}{1200\ \text{cm}^3}$$

$$= 1.7\ \text{g/cm}^3$$

8. Students will fill in the two right columns on each of the following five tables.

Substance Tested: Water				
A	B	C	D	E
Volume (mL)	Mass of Cylinder Only (g)	Mass of Cylinder and Substance (g)	Mass of Substance Only (g)	Ratio of Mass to Volume (g/mL)
50	105	155	**50**	$\frac{50}{50} = 1.0$
100	105	205	**100**	$\frac{100}{100} = 1.0$
150	105	255	**150**	$\frac{150}{150} = 1.0$
200	105	305	**200**	$\frac{200}{200} = 1.0$
250	105	355	**250**	$\frac{250}{250} = 1.0$

Substance Tested: Corn Oil				
A	B	C	D	E
Volume (mL)	Mass of Cylinder Only (g)	Mass of Cylinder and Substance (g)	Mass of Substance Only (g)	Ratio of Mass to Volume (g/mL)
50	105	151	**46**	$\frac{46}{50} = 0.92$
100	105	197	**92**	$\frac{92}{100} = 0.92$
150	105	243	**138**	$\frac{138}{150} = 0.92$
200	105	289	**184**	$\frac{184}{200} = 0.92$
250	105	335	**230**	$\frac{230}{250} = 0.92$

Substance Tested: Glycerol				
A	B	C	D	E
Volume (mL)	Mass of Cylinder Only (g)	Mass of Cylinder and Substance (g)	Mass of Substance Only (g)	Ratio of Mass to Volume (g/mL)
50	105	168	**63**	$\frac{63}{50} = 1.26$
100	105	231	**126**	$\frac{126}{100} = 1.26$
150	105	294	**189**	$\frac{189}{150} = 1.26$
200	105	357	**252**	$\frac{252}{200} = 1.26$
250	105	420	**315**	$\frac{315}{250} = 1.26$

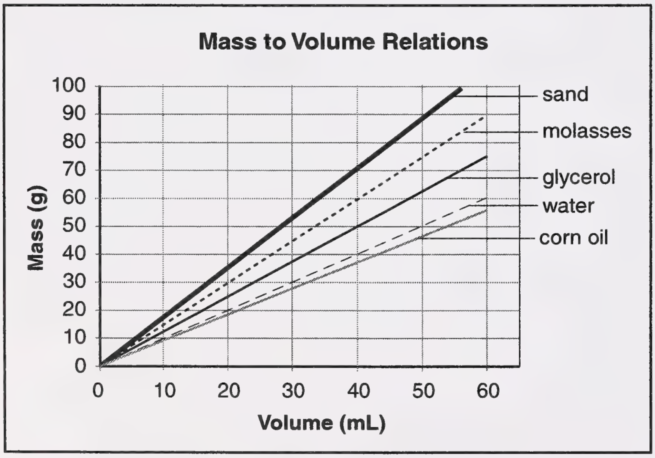
Substance Tested: Molasses				
A	B	C	D	E
Volume (mL)	Mass of Cylinder Only (g)	Mass of Cylinder and Substance (g)	Mass of Substance Only (g)	Ratio of Mass to Volume (g/mL)
50	105	180	**75**	$\frac{75}{50} = 1.5$
100	105	255	**150**	$\frac{150}{100} = 1.5$
150	105	330	**225**	$\frac{225}{150} = 1.5$
200	105	405	**300**	$\frac{300}{200} = 1.5$
250	105	480	**375**	$\frac{375}{250} = 1.5$

Substance Tested: Sand				
A	B	C	D	E
Volume (mL)	Mass of Cylinder Only (g)	Mass of Cylinder and Substance (g)	Mass of Substance Only (g)	Ratio of Mass to Volume (g/mL)
50	105	195	**90**	$\frac{90}{50} = 1.8$
100	105	285	**180**	$\frac{180}{100} = 1.8$
150	105	375	**270**	$\frac{270}{150} = 1.8$
200	105	465	**360**	$\frac{360}{200} = 1.8$
250	105	555	**450**	$\frac{450}{250} = 1.8$

9. Textbook question 2 from "Analyze," page 56:

2. All the mass-to-volume ratios remain constant. Explanations will vary: the same volume is added each time; the amount of mass added each time is constant.

10. Sample graphs are shown on the grid.



11. The mass is 97 g.

12. The volume of bolts = volume of water and bolts – volume of water

$$= 62.5\ \text{mL} - 50\ \text{mL}$$
$$= 12.5\ \text{mL}$$
$$= 12.5\ \text{cm}^3$$

Note: Because the bolts are solid, use cm^3 rather than mL.

13. $\text{Density} = \dfrac{\text{mass}}{\text{volume}}$

$$= \frac{97\ \text{g}}{12.5\ \text{cm}^3}$$
$$= 7.76\ \text{g/cm}^3$$

The density of the metal is $7.76\ \text{g/cm}^3$.

14. According to the table on page 52 of the textbook, the bolts are probably made of iron.
Comment: Iron has a density closest to the calculated value. Experimental error or impurities in the metal may be responsible for the difference between the calculated value and the density of iron.

15. Textbook questions 1 and 3 from "Topic 5 Review," page 58:

1. The particles in solids are closer together and are held in a fixed position. With the particles held in place, they can support stronger forces.

3. The mass-to-volume ratio gives students the density of the substance.

Section 2: Lesson 3

7. Correct answers will vary. These guidelines should be followed:

- Predictions should be consistent. The density of the object is greater than 1g/cm^3—the density of water—if, and only if, the object sinks.
- The weight of the object is greater than the buoyant force if, and only if, the object sinks.
- If the object is seen to sink, then the density should be greater than 1g/cm^3.
- The evaluation reflects whether there is agreement between the observations and predictions.

8. Improvements could be as follows:

- Use more precise fluid-measuring devices.
- Catch, measure volume, and weigh displaced fluid in the same container to avoid water loss.
- Have a longer, more pointed spout on the overflow pitcher to decrease water loss.

12. Textbook steps 1 to 3 from "What to Do," page 68:

1. $F_{\text{buoyant force}} = W_{\text{weight in air}} - W_{\text{weight in liquid}}$

Liquid	Buoyant Force (N)	Calculations of Buoyant Forces
1	0.15	1.0 N – 0.85 N
2	0.10	1.0 N – 0.90 N
3	0.30	1.0 N – 0.70 N

2. The liquids in order of buoyant force from the greatest to the least are liquid 3, liquid 1, and liquid 2.

3. The liquids in order of density from greatest to smallest are liquid 3, liquid 1, and liquid 2. This listing is the same as the listing for step 2.

13. Textbook questions 1 to 3 from "Analyze," page 68:

1. As fluid density increases, the number of particles pushing up also increases. This causes a higher buoyant force. The mass and volume of the 100 g object were the same in each case, so the volume of the displaced liquid was also the same. However, the weight of that volume of displaced liquid must vary. One mL of a dense substance has more particles/mass than 1 mL of a less-dense substance, therefore, it would weigh more. Archimedes' principle states that the weight of the displaced fluid is equal to the buoyant force. Therefore, a denser fluid with more weight per-unit-volume, would produce a higher buoyant force.

2. The hydrometer floats highest in the densest liquid and lowest in the least-dense liquid.

3. The greater the height of the hydrometer in a fluid, the greater the buoyant force of the fluid on the submerged mass in set 1.

Comment: The buoyant force of the various liquids on the hydrometer stays the same. In the denser fluid the hydrometer sits higher and displaces a smaller volume of liquid.

14. Textbook questions 1, 2, 4, and 5 from "Topic 6 Review," page 69:

1. Increasing the average density of plastic, which normally floats, by attaching more dense material to it will cause it to sink. Shaping steel to include air pockets will decrease its average density and allow it to float.

2. Archimedes' principle states that the buoyant force acting on an object equals the weight of the fluid displaced by the object.

4. Volume = length × width × height

$$= 5 \text{ cm} \times 3 \text{ cm} \times 2 \text{ cm}$$
$$= 30 \text{ cm}^3$$

$$\text{Density} = \frac{\text{mass (g)}}{\text{volume (cm}^3\text{)}} = \frac{235 \text{ g}}{30 \text{ cm}^3} = 7.8\dot{3} \text{ g/cm}^3$$

Based on the information in Table 1.5 on page 52 of the textbook, the block is probably made of iron. It will float on mercury because it is less dense. Remind students that 1 g/cm^3 = 1 g/mL.

5. **(a)** The object will sink.

(b) The object will be neutrally buoyant so it will float at that particular level in the fluid. It may be submerged, partially submerged, or it may sit on top of the fluid.

(c) The object would be pushed upward until the buoyant force equals the gravitational force. This would be similar to dropping a log in the water from a bridge. It would submerge initially but the buoyant force would push the log back up until it floats. Partially submerged, waterlogged wood can usually float below the surface—this creates a boating hazard.

ASSIGNMENT BOOKLET 1B

Science 8
Module 1: Section 2 Assignment

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Grading:

Teacher's Comments

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- Has your work been reread to be sure the spelling and details are correct?
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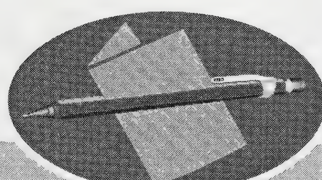
Science 8

Module 1

Mix and Flow of Matter

Assignment Booklet 1B



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FOR TEACHER'S USE ONLY

Summary

	Total Possible Marks	Your Mark
Section 2 Assignment	50	

Teacher's Comments

Science 8
Module 1: Mix and Flow of Matter
Assignment Booklet 1B
Section 2 Assignment
Learning Technologies Branch

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ASSIGNMENT BOOKLET 1B
SCIENCE 8: MODULE 1
SECTION 2 ASSIGNMENT

Your mark for this module will be determined in part by how well you do your assignments.

This Assignment Booklet is worth 50 marks out of the total 136 marks for the assignments in Module 1. The value of each assignment and each question is stated in the left margin.

Work slowly and carefully. If you have difficulty, go back and review the appropriate topic.

Be sure to proofread your answers carefully.

50

Section 2 Assignment: Properties of Fluids

Read all parts of your assignment carefully and record your answers in the appropriate places.

Questions 1 to 5 are based on Part 1 of "Investigation 1F: Determining Flow Rate," starting on page 40 of the Student Module Booklet.

6

1. Determine the flow rates of the three liquids you are using. Show your work and place your results in the following table.

Liquid	Flow Rate (cm/s)

1

2. Use the following data table to rank the liquids from the fastest flow rate (1) to the slowest flow rate (3).

Liquid	Ranked Flow Rate

1

3. Use the following data table to rank the liquids from the highest viscosity (1) to the lowest viscosity (3).

Liquid	Ranked Viscosity

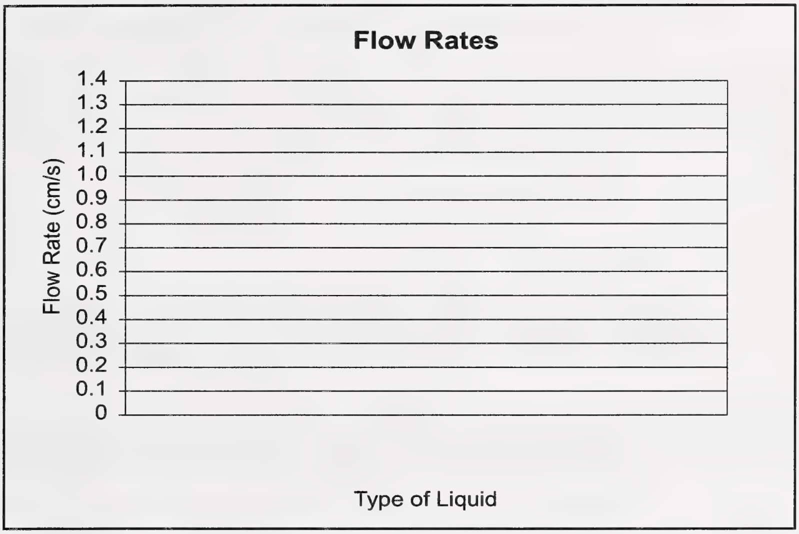
1

4. How is the flow rate related to the viscosity?

____

____

Use the following grid for question 5.



3 **5.** Make a bar graph on the grid. The bar graph is to show the flow rate (cm/s) along the vertical axis and the type of liquid along the horizontal axis. Base your graph on the flow-rate data you obtained in question 1.

Return to page 42 of the Student Module Booklet and continue with Lesson 1.

Questions 6 to 9 are based on Part 2 of "Investigation 1F: Determining Flow Rate," starting on page 43 of the Student Module Booklet.

2 **6.** How did the responding variable change in Part 2 as compared to Part 1?

___

3 **7.** Compare the falling rates of an object in the three different liquids. Use the following data table to rank the liquids from the fastest rate (1) to the slowest rate (3).

Liquid	Ranked Fall Rate

1 **8.** How did the flow-rate ranking in question 2 compare to the fall-rate ranking in question 7?

____

2 **9.** What are two ways that you can find out whether the viscosity of one liquid is different from the viscosity of another liquid?

____

____

Return to page 45 of the Student Module Booklet and continue with Lesson 1.

1 **10.** Circle the letter of the best response.

A mechanic suggests that for easier starting during the winter months, the oil in your family car should be 5W-30 oil instead of 10W-30 oil. The characteristic of the 5W-30 oil that makes it more suitable for cold weather is

A. lower viscosity
B. higher viscosity
C. lower compressibility
D. higher compressibility

1 **11.** Andrea was trying to get the last bit of pancake syrup out of its bottle. She put a little water into the bottle to dilute the syrup, because she thought the diluted syrup would come out of the bottle more easily.

What property of the diluted syrup would allow the syrup to pour more easily out of the bottle?

____

1 **12.** Circle the letter of the best response.

How does the viscosity of a liquid and a gas change with a temperature increase?

A. The viscosities of both a liquid and a gas decrease.
B. The viscosities of both a liquid and a gas increase.
C. The viscosity of a liquid increases and the viscosity of a gas decreases.
D. The viscosity of a liquid decreases and the viscosity of a gas increases.

3

13. The Alaska oil pipeline from Prudhoe Bay to Valdez is built mostly above ground to avoid melting the permafrost. Natural gas remains in a gaseous state down to temperatures as low as –150°C. It would, therefore, be a gas at Arctic temperatures.

Suppose the pipeline was to carry natural gas to Valdez on alternate weeks. Predict whether or not each of the fluids—oil or natural gas—would need to be heated to improve its flow rate through the pipeline. Use information from this lesson to explain your predictions.

___

___

___

___

Return to page 47 of the Student Module Booklet and continue with Lesson 2.

Questions 14 to 16 are based on "Investigation 1H: Determining Density," starting on page 49 of the Student Module Booklet.

14. The mass-to-volume ratio indicates density.

1 **a.** From this ratio, how can you tell which substance is the most dense?

___

___

1 **b.** According to this ratio, which substance is the most dense?

___

15. The graph slopes also indicate density.

1 **a.** How can you tell from the slope which substance is the most dense?

___

___

1 **b.** According to the slope, which substance is the most dense?

___

1

16. Circle the letter of the best response.

Based on the particle model of matter, which answer best describes the densest substance?

A. There are 100 particles in a volume of 2 cm^3.
B. There are 1000 particles in a volume of 2 cm^3.
C. There are 100 particles in a volume of 1 cm^3.
D. There are 1000 particles in a volume of 1 cm^3.

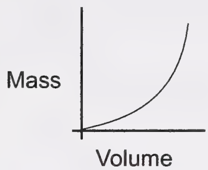
Return to page 51 of the Student Module Booklet and continue with Lesson 2.

1

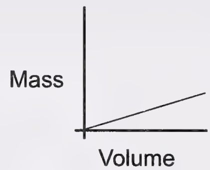
17. Circle the letter of the best response.

Which graph sketch shows a correct relationship between mass and volume for a substance?

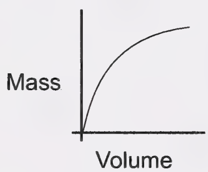
A.



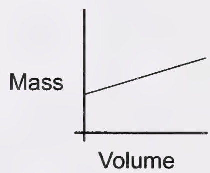
C.



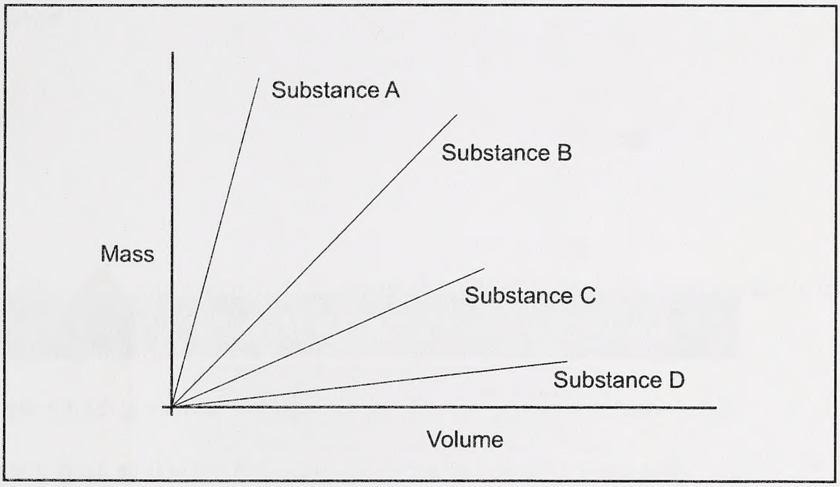
B.



D.



Refer to the following graph to complete question 18. Each line shows the relationship between mass and volume for different substances.



1

18. Circle the letter of the best response.

Which substance has the lowest density?

A. Substance A
B. Substance B
C. Substance C
D. Substance D

5

19. A rectangular block, made of an unknown substance, measures 5.0 cm wide, 10.0 cm long, and 3.0 cm high. It has a mass of 405 g. Use the density formula to determine the density of the substance, and identify it using Table 1.5 on page 52 of the textbook. Be sure to include formulas and units.

2 **20.** A graduated cylinder is filled with 80 mL of a liquid. The liquid has a mass of 72 g. What is the density of the liquid? Show your work.

Return to page 53 of the Student Module Booklet and continue with Lesson 3.

2 **21.** A student made this rule: As the temperature decreases, the density of a substance increases.

How could you quickly and easily prove that water is an exception to the student's rule?

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2 **22.** What is the size of the buoyant force acting on an object? Base your answer on Archimedes' principle.

____

____

1 **23.** **a.** Suppose an object was submerged in pure water, and the object stayed suspended. How did the weight of the object compare to the buoyant force on the object?

____

____

2 **b.** Suppose the same object was then put below the surface in a saltwater solution. Would the object stay suspended below the surface? Explain.

____

____

2

24. The weight of a certain object in air was measured to be 9.8 N. When this object was immersed in glycerol, its apparent weight was found to be 6.1 N. What buoyant force acted on the object while it was in the liquid? Include units. Show how you determined your answer.

1

25. In what order, from top to bottom, would the following insoluble liquids come to rest after being stirred together?

Liquid	Density (g/mL)
A	7.3
B	0.91
C	2.4
D	6.5

_____ _____ _____ _____

Submit your completed Assignment Booklet 1B to your teacher for assessment.
Then return to page 66 of the Student Module Booklet and begin Section 3.

ASSIGNMENT BOOKLET DECLARATIONS

The Student's Declaration is to be signed by a student registered at the Alberta Distance Learning Centre. If the student is under 16, the Supervisor's Declaration is to be signed by the student's supervisor, who is usually a home instructor, teacher, or home-schooling coordinator. Failure to complete this page may invalidate the assignment results.

STUDENT'S DECLARATION

- I have followed the instructions outlined in the Student Module Booklet.
- I have completed the activities to prepare myself for the assignments in this Assignment Booklet.
- I completed the assignments in this Assignment Booklet by myself.

____

Student's Signature

SUPERVISOR'S DECLARATION

I hereby certify that I have supervised the learning activities completed by ______________________.

Student's Name

I also certify that to the best of my knowledge the assignments in this Assignment Booklet were completed independently by this student.

____

Supervisor's Signature

If you, the student or supervisor, have any comments or observations regarding this module, write them in the following space.

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